PATENT SPECIFICATION (11) 1 363 322

1 363 322

(21) Application No. 18455/72 (22) Filed 20 April 1972 (19)

(31) Convention Application No. 23375 (32) Filed 20 April 1971 in

(33) Italy (IT)

(44) Complete Specification published 14 Aug. 1974

(51) International Classification B29F 1/04

(52) Index at acceptance

B5A 1G10 1G5F 1R1 4C2 2B1 2D1X 3D9X 3DX

(54) METHOD AND APPARATUS FOR MOULDING THERMOSETTING MATERIALS

(71) I, SERGIO FARINELLI, of Italian Nationality, of Via dei Chiaramonti, 19, Milan, Italy, do hereby declare the invention,

for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method and an apparatus for moulding thermosetting materials.

As is known the evolution of the moulding technology of thermosetting materials (Bakelite (Registered Trade Mark), urea and the like) has led, as the most updated and recent approach, to the moulding with the "plasticization-transfer" that is, by injecting billet of material, as prepared by a reciprocating screw plasticizing device, on horizontally mounted machines. According to this method, after the material has been plasticized in the plasticizing device, the plasticizing screw goes forward through a preselected stroke causing a portion of the material to emerge from the barrel end then to be severed by a cutter, which serves also to close the end of the barrel during the plasticizing stage. The portion of material which has thus been severed is the "billet", which then must be conveyed to a position in front of a transfer piston, that is, an injection piston, in order to be able to be injected into the mould.

A known method for achieving such a billet transfer is as follows: the plasticizing device is placed parallely of the injection piston and is so oriented that its direction of dispensing of the plasticized material is concurrent with the direction of the injection strokes of the piston. The billet emerging or projecting from the plasticizing device is caused to enter a tube placed in front of the output of the plasticizing device. Once the billet has been severed by the cutter, the billet-containing tube is brought before the injection piston, that is, in axially aligned position between the piston and the mould, by causing the tube to be either translated or rotated about an axis which is parallel to the tube axis. The injection piston is caused to advance, pushes the billet into the mould and the injection is thus carried out.

This method has the defect that the portion of the billet, which during the plasticizing stage was in contact with the cutter and therefore has stood for a longer period of time within the plasticizing device, is polymerized to a greater degree and consequently has begun to harden and is the one which is injected first into the mould cavity as the piston is advanced to carry out the injection step. This fact might lead to a few moulding difficulties.

Another approach provides for arranging the plasticizing device above and at an angle with respect to the transfer piston. The billet of plasticized material is caused freely to emerge from the plasticizing device and, as it is severed by the cutter, it falls into a specially provided housing placed ahead of the injection piston. Such a housing, before the injection piston is fed forward, is caused to rotate through 180 degrees with respect to its own vertical axis so that the portion of the billet which first enters the mould cavity at the injection is one which last emerged from the plasticizing device, whereas the more hardened portion, that is, the one which contacted the cutter, is unable to reach the mould cavity and remains in the injection channels thereof.

This method affords very satisfactory results in moulding, but has the defect that, especially when the billet to be injected are very short, they can badly be positioned as they, severed by the cutter, fall into the housing placed ahead of the injection piston.

The main object of the present invention is thus to provide a method for moulding thermosetting materials with the "plasticizing-transfer procedure", in which the problem of transferring the billets emerging from the plasticizing device is solved so as to combine the advantages of the two approaches mentioned above, while simultane-

ously doing away with or substantially reducing the respective defects.

From one aspect the invention consists in a method for moulding thermosetting plastics material, comprising the steps of forming a bar of plasticized thermosetting plastics material in the initially closed delivery mouth of a plasticizing device, opening said delivery mouth, causing a portion of said bar to project from said delivery mouth and into an open-ended hollow body arranged in front of said delivery mouth and in alignment therewith, cutting said portion of the bar from the remainder of the bar in the plasticizing device to form a billet, transferring said hollow body to a position in which it is axially aligned with and between a mould and an injection piston in parallel with the plasticizing device and oriented so that the direction of the injection strokes thereof is concurrent with the direction of delivery of the plasticizing device, the transfer of said hollow body being effected by coupling a translational movement with a 180 degree rotational movement about an axis which is perpendicular to the direction of injection, and advancing the injection piston through said hollow body and into the mould thereby to inject the billet into cavities of the mould.

The invention also consists in apparatus for moulding thermosetting plastics material, comprising a plasticizing device having a closable delivery mouth in which a bar of thermosetting plastics material can be formed an open-ended hollow body which in one position is arranged in front of the delivery mouth and in alignment therewith, means for causing, in use, a portion of the bar to project from the delivery mouth and into said hollow body, means for cutting the portion of said bar from the remainder of the bar to form a billet, a mould, an injection piston in parallel with the plasticizing device and oriented so that the direction of its injection strokes is concurrent with the direction of delivery of the plasticizing device, and means for causing said hollow body to carry out a translational movement coupled with a 180° rotational movement about an axis which is perpendicular to the direction of injection to transfer said hollow body from said position into another position in which it is axially aligned with and between said mould and said injection piston so that the piston can inject the billet into the mould.

Such a method offers the advantage that billets, even of a reduced length, are always correctly positioned with respect to the injection piston and that, due to the 180 degree rotation, the portion of the billet which is injected first into the mould cavity is the one which last emerged from the plasticizing device and thus the less hardened one, the moulding being therefore facilitated.

In order that the invention may be more readily understood reference will now be made to the accompanying drawings, in which Figures 1 to 5 illustrate the several steps of the method according to the invention.

More particularly, Figure 1 shows a plasticizing device 1, whose delivery mouth is initially closed by a cutter 3. Within the plasticizing device 1, between the reciprocating screw 2 thereof and the cutter 3, there is a bar of a plasticized thermosetting material 4, in readiness for being dispensed. Immediately past the cutter 3 and in axial alignment with the plasticizing device 1 an op hollow body is arranged; which consists of a cylindrical tube 5, open at both ends, which is intended to receive a billet. Beneath the plasticizing device 1 and parallel thereto an injection piston 6 is arranged, which is so oriented that the direction of its injection strokes is concurrent with the direction of delivery of the plasticizing device 1. Before the injection piston 6, but properly spaced therefrom, there is arranged a mould 7 equipped with moulding cavities 8 which communicate with a cylindrical chamber 9 in axial alignment with the piston 6.

Considering as the starting conidtion that of Figure 1, the first step to be performed is to lift the cutter 3 in the direction of arrow A (Figure), so as to open the delivery mouth of the plasticizing device 1. Thereafter, the screw 2 is advanced in the direction of the arrow B (Figure 2), pushing the bar of plasticized material 4 so that it may partially emerge from the plasticizing device 1 and be introduced partially into the collecting tube 5. Subsequently the cutter 3 is depressed again (arrow C of Figure 3) so as to sever a portion of the bar 10, forming the billet, from the remainder of the bar 4 which is still in the plasticized device; due to the effect of its tapered shape, the cutter 3 also causes a further axial thrust on the billet 10, which is thus entirely housed in the tube 5. The tube 5 with its billet 10 is then transferred (Figure 4) to a position which is intermediate between the mould 7 and the injection piston 6, and in alignment therewith, by a double movement of translation along the arrow D and a 180 degree rotation along the direction of the arrow E (that is, about an axis which is parallel to the direction of translation). Such a twofold movement, according to the requirements, can be formed by two separate movements and possibly in time sequence, and also by a single helical movement; the rotational movement, moreover, can also take place about an axis other than the one cited above but anyhow perpendicular to the direction of injection. Lastly,

the injection piston 6 is advanced in the direction of the arrow F (Figure 5) passing through the tube 5 and entering the cylindrical cavity 9 of the mould 7, so as to inject the billet 10 (exactly positioned with the less hardened end pointing towards the mould) into the several cavities 8 of the mould.

WHAT I CLAIM IS:—

1. A method for moulding thermosetting plastics material, comprising the steps of forming a bar of plasticized thermosetting plastics material in the initially closed delivery mouth of a plasticizing device, opening said delivery mouth, causing a portion of said bar to project from said delivery mouth and into an open-ended hollow body arranged in front of said delivery mouth and in alignment therewith, cutting said portion of the bar from the remainder of the bar in the plasticizing device to form a billet, transferring said hollow body to a position in which it is axially aligned with and between a mould and an injection piston in parallel with the plasticizing device and oriented so that the direction of the injection strokes thereof is concurrent with the direction of delivery of the plasticizing device, the transfer of said hollow body being effected by coupling a translational movement with a 180 degree rotational movement about an axis which is perpendicular to the direction of injection, and advancing the injection piston through said hollow body and into the mould thereby to inject the billet into cavities of the mould.

2. A method according to claim 1, wherein said translational and rotational movements take place in two subsequent stages.

3. A method according to claim 1, wherein said movements of translation and rotation take place simultaneously.

4. A method according to claim 3, wherein said translational and rotational movement are combined into a single helical movement.

5. Apparatus according for mould thermosetting plastics material, comprising a plasticizing device having a closable delivery mouth in which a bar of thermosetting plastics material can be formed, an open-ended hollow body which in one position is arranged in front of the delivery mouth and in alignment therewith, means for causing, in use, a portion of the bar to project from the delivery mouth and into said hollow body, means for cutting the portion of said bar from the remainder of the bar to form a billet, a mould, an injection piston in parallel with the plasticizing device and oriented so that the direction of its injection strokes is concurrent with the direction of delivery of the plasticizing device, and means for causing said hollow body to carry out a translational movement coupled with a 180° rotational movement about an axis which is perpendicular to the direction of injection to transfer said hollow body from said position into another position in which it is axially aligned with and between said mould and said injection piston so that the piston can inject the billet into the mould.

6. Apparatus according to claim 5, wherein said hollow body has a cylindrical configuration.

7. A method according to claims 1 to 4, substantially as hereinbefore described and illustrated in the accompanying drawings.

8. Apparatus according to claims 5 and 6, substantially as hereinbefore described and illustrated in the accompanying drawings.

BARON & WARREN,
16, Kensington Square,
London, W8,
Chartered Patent Agents.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1974.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1363322 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

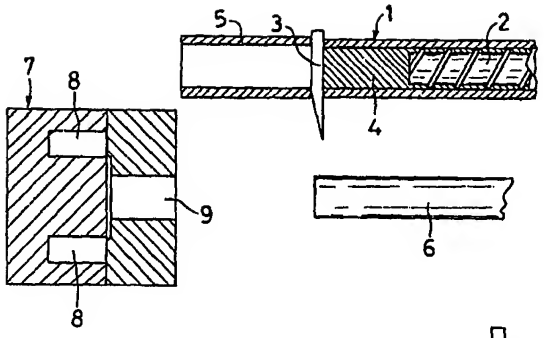

Fig.1

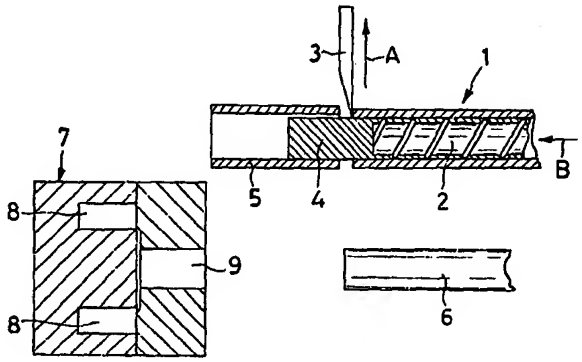

Fig.2

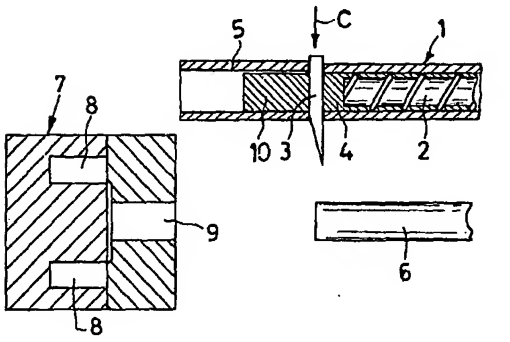

Fig.3

1363322 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

Fig.4

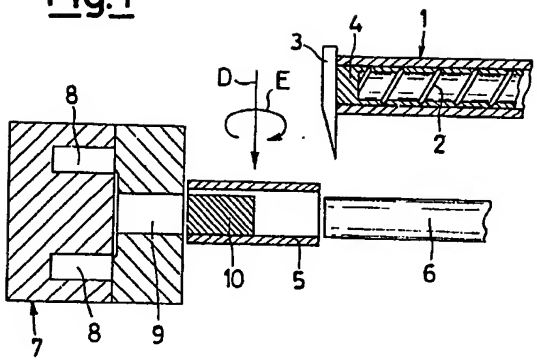

Fig.5